

Math 118 Summer Session 2, 2005

Sample Hour Exam 1

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I have not checked this exam for length. Things may change a lot. Do not assume that the actual exam will be identical to this sample exam. Topics which do not appear on this sample exam may still appear on Friday's exam paper. The exam will be similar to the quizzes but with a few more "theory" questions. The quizzes focussed on "can you do this calculation?" The hour exam will also ask this but it will also ask "do you understand what is going on?"

The following directions will be on your exam paper:

Answer all questions. Full marks = 100 points. Not all questions are worth the same number of points. You have 55 minutes to complete this exam. It is very important to show all your work in order to obtain full credit for your solution. Read questions carefully.

Name: _____

1. Use the first-fit decreasing bin-packing algorithm to pack the following weights into bins that can hold no more than 9 lbs.
5 lbs, 7 lbs, 1 lb, 2 lbs, 4 lbs, 5 lbs, 1 lb, 1 lb, 3lbs, 6 lbs, 2lbs
2. Use the next-fit bin-packing algorithm to pack data files of the following sizes onto compact discs that can hold no more than 700 MB.
100 MB, 500 MB, 250 MB, 350 MB, 400 MB, 250 MB, 450 MB, 200 MB, 50 MB

3. Eight board members vote by approval voting on four candidates, A,B,C, and D, for new positions on their board as indicated in the following table. An “X” indicates an approval vote.

	Voters							
	1	2	3	4	5	6	7	8
A	X	X	X	X		X	X	X
B		X	X		X	X		X
C		X		X	X		X	X
D	X		X	X	X	X	X	

Which candidate(s) is (are) elected if 80% approval is necessary and at most two are elected?

4. In a few sentences, explain why the sequential pairwise voting satisfies the Condorcet winner criterion.
5. In a weighted voting system, what does it mean for a voter to be a dictator? Give an example of a weighted voting system with four voters that has a dictator.
6. Thirty board members must vote on five candidates: $X, Y, Z, U,$ and V . Their preference rankings are summarized in the table below. Find the winner using sequential pairwise voting with the agenda X, Y, Z, U, V .

Rank	12	10	8
First Choice	X	Y	Z
Second Choice	U	Z	U
Third Choice	Y	X	X
Fourth Choice	Z	U	V
Fifth Choice	V	V	Y

7. Thirty board members must vote on five candidates: $X, Y, Z, U,$ and V . Their preference rankings are summarized in the table below. Find the winner using the Borda count.

Rank	12	10	8
First Choice	X	Y	Z
Second Choice	U	Z	U
Third Choice	Y	X	X
Fourth Choice	Z	U	V
Fifth Choice	V	V	Y

8. In the weighted voting system $[q : w(A), w(B), w(C), w(D), w(E), w(F)] = [8 : 5, 2, 2, 2, 2, 2]$, find the Banzhaf Power index for voters A and B .
9. Calculate the Shapley-Shubik Power index for each voter in the weighted voting system $[15 : 8, 7, 6]$.
10. The owner of a new pet store wishes to display tropical fish in display tanks. The following table shows the incompatibilities between the species, in the sense that an X indicates that it is unwise to allow those species in the row and column at the X to be in the same tank.

	A	B	C	D	E	F	G	H	I
A						X	X		X
B			X					X	
C		X			X			X	
D					X	X		X	
E			X	X			X		
F	X			X			X		X
G	X				X	X		X	X
H		X	X	X			X		
I	X					X	X		

Using the vertices marked below, draw a graph that will be useful in solving this problem. Use this graph to do the following: what is the minimum number of tanks needed to display all the fish she wishes to sell? Which fish go in which tank?